Redirect - Rebuttal Testimony of

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TTTRAN

Consolidated Edison's Research Program at Indian Point

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Reference:

Testimony of Dr. James T. McFadden and Mr. Harry J. Woodbury (5 February 1973): "Indian Point Studies to Determine the Environmental Effects of Once Through vs. Closed Cycle Cooling at Indian Point Unit No. 2"

Consolidated Edison's Research Program at Indian Point

Within the time available, the staff has examined the contents of the referenced document and finds that, generally speaking, it is a thorough, ambitious, and well-presented research proposal. However, it is not likely that the results of the five-year study proposed by Consolidated Edison will produce sufficient information to properly quantify possible plant impact, particularly on fish populations in the Hudson River. Following a lengthy discussion of the methods by which parameters of fish populations in the river will be studied, the Applicant provides on p. 33 the following criteria which will be used for assessing impacts on fish populations:

1) Decline in density of Juvenile II, Juvenile III, and Age Group I fish coincident with startup of Unit #2 and not accounted for by changes in egg production by parental stock or by natural environmental fluctuations.

2) Large fraction of the population of eggs, larvae, or Juvenile I fish entrained.

3) High mortality rate of entrained organisms.

4) Substantial reduction in survival rate from egg stage to Juvenile II, etc. accounted for by entrainment.

5) Substantial percentage of stock from significant area of estuary impinged on intake screens.

6) Lack of compensatory increase in survival rate among Juvenile II and Juvenile III fish following fulfillment of criterion (4).

7) Lack of compensatory increase in survival rate among Juvenile III to Age Group I fish following fulfillment of criterion (5).

8) Increase in growth rate of fish. Note that increased growth rate is both a classical indicator of a substantial decrease in stock density (hence an indicator of adverse impact) and a compensatory response to reduction in density (hence an indicator of some capability of the fish stock to sustain itself in the face of increased mortality).

9) Attainment of sexual maturity at an earlier average age. The note in (8) above identifying the criterion as an indicator of both adverse impact and compensatory capability of the population applies here as well.

10) Continuing decline in population size or stabilization at an undesirably low level following a period of decline, as predicted by a simulation model of the fish population which integrated the empirical data from the ecological studies.

It is very doubtful that within the time frame presented for the study that these criteria can be fully, or in many cases even partially, assessed. Of the criteria presented, it is likely that only items 2 and 5 could be accurately determined; however, if the mortality of entrained organisms is very high and also very immediate, item 3 also might be determined.

It appears unlikely from the techniques outlined that a decline in density of Juvenile II, Juvenile III, and Age Group I fish coincident with the start of Unit 2 could be separated from changes in egg production by the parental stock or by other natural environmental fluctuations. This conclusion is based on the fact that the sampling locations which have been outlined in this study will not sample the entire spawning zone. Thus, egg deposition outside the study limits cannot be accounted for and any changes in the distribution of spawning would materially affect any estimate of egg production by the parental stock. Furthermore, fluctuations caused by natural environmental variations can only be detected if those variations are considered within the sampling framework of the study. It is not apparent from the discussions presented in this proposal that the study design will be flexible enough to evaluate cause-and-effect relationships as they are related to environmental variation.

Items 4, 6, and 7 are related to determining compensatory increases in survival rate which may or may not occur as a result of mortality from both entrainment and impingement. It would appear highly unlikely that the estimates of survival rate will be sufficiently precise to separate plant vs. natural effects and even less likely that survival rate can be determined to be different from survival rates which existed before the plant went into operation. This is a consequence of the fact that the projected effects of plant operation are comparatively small in respect to the variation inherent in the sampling techniques which will be used. Furthermore, the precision of estimates in the past is sufficiently low that a greater than 50% variation can readily be accounted for within the sampling error. In effect, the background noise in the sampling and the problem of uncontrolled variation in natural variables like fresh water flow and temperature would make it difficult to detect the phenomenon of compensation, which is not easily demonstrated in experimental situations which involve control and replication.

Criteria 8 and 9 are believed by the Applicant to have both negative and positive indications. In the staff's opinion, the numerous alternative cause-and-effect relationships which would change growth rate or age of attainment of sexual maturity would confuse any conclusions resulting from observations involving changes in growth rate of the fish or age at sexual maturity. As an example, the temperature increase which will occur as a result of operation of the several power plants may in fact increase the growth rate of the fish through an effective lengthening of the growing season. This factor is not evaluated in the Applicant's proposed study program. As presented, any observed increase in growth rate would be falsely interpreted as a response of the population showing a substantial decrease in density and a compensatory response in growth as a function of the reduced density. Likewise, the alternative of no change in growth rate may also be falsely interpreted as an indication that no substantial decrease in stock density has occurred (and as a result no compensation should be expected).

It is also noted at this point that a change in the attainment of sexual maturity at an earlier age for a long-lived species such as striped bass is not likely to be determined within the framework of the study since striped bass do not become sexually active, at least in the females, until their 5th year of age. As a consequence, there will be only a maximum of 1 or 2 years of data on this point (perhaps none) prior to the termination of the program.

The final criterion is, to a large extent, the central point of the controversy. At the end of the 5-year study, because of a 4 to 5-year lag before the effects of an adverse impact would show up in the adult population of striped bass, the Applicant and the Staff of the AEC would be forced to evaluate whether or not there will be a continuing decline in the population size or a stabilization at an undesirably low level following a period of decline through a simulation model based on only slightly more sophisticated data than is presently available.

In this context it is noted that a large proportion of the important information needed to interpret the effects of the plant and potential changes in the striped bass population will not be gathered during this study. These include the controlling factors of cause-and-effect relations in the survival and fecundity rates in the adult population. Without this information, a more reliable model which could be utilized for projecting the impact resulting from the operation of I.P. Unit 2 cannot be formulated.

Furthermore, it would not be possible by the termination of the study to determine whether or not any effect has occurred with the result of a substantial reduction in population of striped bass along the Atlantic Coast. It is unlikely that, at that time, the cause-and-effect relationship could be established due to the inherent variability of estimates of the population size which are taken by the fishery.

A similar situation occurring in the San Joaquin system some 20 years ago may be of value in determining whether any study of the effects of plant operation undertaken within the proposed five-year period could produce definitive conclusions. An intensive study of the distribution of larval striped bass (as well as other anadramous fishes) was made in the San Joaquin system to determine the potential effect of the entrainment of larval anadramous fish by a then proposed water pumping project. It was believed by the investigators that the results of the study showed that some means of protecting the larval anadramous fishes, particularly striped bass, was needed or the fishes in that region would be in jeopardy. After the plant was put into operation, the population of striped bass began to decline and has declined to the present. Furthermore, there is a direct relationship between the abundance of young striped bass (at a length of 1-1.5 inches) and later recruitment to the fishery for that year class. In addition there are inverse correlations which exist between the abundance of 1.5 inch bass and numerous environmental factors, including the kill of small striped bass at the Tracy pumping plant. Unfortunately, the intensive investigations of this population which have been conducted since the mid-40's have not provided sufficient information to establish the cause-and-effect relationships which exist in that population. As a result, the cause of reduced recruitment has not yet been resolved.

SUMMARY

The application of analysis of variance and multiple regression techniques, which are mentioned in the research proposal, are powerful tools for testing hypotheses and quantitatively characterizing a system. Nevertheless, any statistical analysis is constrained not only by the quality of the data but by the experimental design. In the present case, the major and unavoidable flaw in the design is that there is no replication and no true control or alternative "treatment" with which to compare the results from the research program. As a result Con Ed will be forced to use pre-1973 data as a baseline. The problem is that the system (Hudson River ecosystem in the vicinity of Indian Point) is extremely complex and it is not sufficiently well described to permit testing of specific hypotheses or application of the above criteria by comparing pre-1973 and post-1973 data.

The staff is aware that there are weaknesses and limitations in the data and the models presently available. The Staff is aware also of the magnitude of the decision that must be made. The Applicant's research program should provide much valuable and needed information. However, the Staff does not believe that this information can appreciably change the opinions and positions of Con Ed or the Staff on the matter of once-through vs. closed-cycle cooling at Indian Point 2. In the Staff's opinion no five-year research program, no matter how competently and unbiasedly designed and executed, can conclusively lead to rejection or tentative acceptance of the nul hypothesis that operation of Indian Point Unit 2 with once through cooling, does not have an unacceptable adverse impact on the aquatic ecosystem, the striped bass population in particular.